



Biochemical Parameters Determination for Prognosis of Retinal Diseases and their Relationship to Cataract, Diabetes and Hypertension Patients in Ibn Al-Haytham Hospital in Baghdad-Iraq

Huda H. Hassan^{1*}, Fayhaa M. Khaleel², Khuthear A. Al Tae³

Abstract

The role of serum retinol activity in association with the Blood sugar level, and their link as biochemical marker risk for lens inflammation and damage stage under pandemic, for the Retinal disease patients with cataract, hypertension, and diabetes, and in healthy for both genders. Total of seventy-five patients and thirty healthy control have been studied. Retinal disease patients were subdivided on the basis of pathological condition into three subgroups (First group was cataract, second was hypertension, and the third group was diabetes. Assessment, of serum retinol activity, and blood glucose levels were done for all groups. The concentricity of serum retinol levels is decreased in diabetic patients than control (13.147 ± 7.195 ($\mu\text{mol/L}$) with 21.930 ± 16.241 ($\mu\text{mol/L}$) versus $P = 0.011$), while for cataract patients, they showed extremely similar concentricity of serum retinol levels to healthy (20.760 ± 15.941 ($\mu\text{mol/L}$) with $P = 0.790$), whilst the retinol-activity was exhibited to be higher in hypertension patients (24.190 ± 21.972 ($\mu\text{mol/L}$) versus $P = 0.663$). retinol activity is correlated significantly negatively with both diabetic patients and cataract. Moreover, blood sugar levels are increased in diabetes than control (10.256 ± 4.119 ($\mu\text{mol/L}$) versus 5.365 ± 1.084 ($\mu\text{mol/L}$) with $P = 0.0001$), in comparison with cataract (5.288 ± 0.9560 ($\mu\text{mol/L}$) with $P = 782$). The retinol levels are correlated significantly negatively for diabetic and cataract patients. The purpose of this work: is to investigate association between retinal diseases with cataract hypertension & diabetes for risk of fasting at least eight hours in Ramadan and out of Ramadan time, and directly pre surgery gets started by artificial intraocular lens, and by estimation of retinol and blood sugar concentrations.

43

Key Words: Retinol Concentrations, Blood Sugar Concentrations, Retinal Disorder Diseases, Cataract, Diabetes, and Hypertension.

DOI Number: 10.14704/nq.2021.19.5.NQ21047

NeuroQuantology 2021; 19(5):43-48

Introduction

The most abundant retinoid present in human body is retinol. Retinol activity facilitate the cellular conversion of light photons into electrical signal. Here the primary function of retina is to receive, then organize, and sending informations of electrical signal by specific optical nerve to brain, enables vision.

Corresponding author: Huda H. Hassan

Address: ¹Lecturer, Department of Chemistry and Biochemistry, College of Medicine, University of Al-Mustansiriyah, Baghdad, Iraq. Student in Department of Chemistry, College of Sciences for Women, University of Baghdad, Baghdad, Iraq;

²Assistant Professor, Department of Chemistry, College of Sciences for Women, University of Baghdad, Baghdad, Iraq;

³Assistant Professor, Ibn Al Haytham Hospital in Baghdad, Iraq. Ministry of Health, Baghdad, Iraq.

¹E-mail: z0771973@gmail.com

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Received: 07 March 2021 **Accepted:** 09 April 2021



In specific type of eye cells Retinol is either changed of retina function or insufficient of retinol concentration cause neurodegeneration processes. Retinal disease is a pathological condition described by clinical symptoms implicated in several eye diseases. Including glaucoma, a state of damage optic nerve responsible for carrying visual signals between the eye and brain and causes vision loss. Glaucoma remains asymptomatic until it is extreme, leading to a high probability that the number of infected people will be much greater than the number considered to be affected (Weinreb, Aung, & Medeiros, 2014). Age-related macular degeneration (AMD) cataract increased risk (Ziu, Ziu, & Zhugli, 2017) by causing blurry vision, and Night blindness, inherited retinal disorders (Ermilov & Nesterova, 2016; Jones-Odeh & Hammond, 2015; MacAskill & Anderson, 2016) and dry eye syndrome is a tear deficit which is mostly due to ocular irritation, resulting in cornea and conjunctive damage (AAO Cornea/External Disease PPP Panel, 2013; Javadi & Feizi, 2011). Systemic conditions like diabetes and high blood pressure have been associated (Tang, Cheng, Ren, Yu, & Shentu, 2016; Zhang, Zhao, Deng, Sun, & Wang, 2016). Untreated retinal diseases can lead to severe vision and sometimes blindness. But the controlled states can preserve, or even restore vision again. Often a new surgical approach is used to minimize damage to the retina (Takahashi et al., 2020). Retinol is a retinoid, fat soluble vitamin, obtained from both animal or plant sources, plays a major physiological role in vision, reproduction and immune function, in human cells activity, and cell growth (Comptour et al., 2016; Deminice et al., 2018; Forga et al., 2016; Gutierrez-Mazariegos, Theodosiou, Campo-Paysaa, & Schubert, 2011; Huang, Liu, Qi, Brand, & Zheng, 2018; Liu et al., 2015; Morny et al., 2019; Sanchez, Shortrede, Vargas-Roig, & Flamini, 2016). It is very essential for maintenance of all life stages from normal embryonic development till adult stages. More over the risk for deficiency of retinol concentration in or over production of this vitamin is regarded as a step for many pathological conditions. Retinal disturbance patients are at greater risk for developing health illnesses such as elevated blood pressure, diabetes or heart disease. Moreover, tests have consistently demonstrated that retinal vascular changes are associated with poorer cognitive output, and also prevalent and incident dementia of Alzheimer's disease (Cheung, Chan, Mok, Chen, & Wong, 2019). In addition to Retinol,

the most bio-active form of vitamin A can trigger biological pathways associated with cancer. The findings of serum retinol and cancer risk retrospective tests were however mixed (de Lima, Garcez, Oliveira, dos Santos, & de Azevedo Paiva, 2017; Hada, Mondul, Weinstein, & Albanes, 2020). The retinal disease is a syndrome for these related diseases. Along these disorders; age, gender, high levels of sugar in the bloodstream, obesity life style season weather, eye injury, trauma to the retina caused by sudden vision changes resulting in Retinal tears, radiation, iodine and iron level are indicator risks related to retinal bioavailability. Changed blood sugar assumes a highly significant job in the pathophysiology of diabetic type two patients, they are affected with related eye conditions for increasing of sugar due to Insulin resistance. Insulin resistance is the main cause of pathogenic factor in the background of increased metabolic disorders in diabetes. Large levels of progressive damage to tiny capillaries in the retina damage small blood vessels in the body, including tiny capillaries throughout the retina. This narrow blood vessel spills blood or other fluid into the eye and allows the retinal tissue to expand, leading to cloudy, blurred or glaucoma vision. Glaucoma a metabolic manifestation associated with diabetes known to be connected of blocking the central vein usually as a result of a blood clot. Vitamin A is not for vision only. But it is a window to the brain and may impact the danger of the eye function and other organs. One of the most essential vitamins for life is vitamin A, and the active biologically form of vitamin A is fat soluble vitamin retinol obtained from both animal (as retinyl esters) and plant sources (from beta-carotene degradation). Vitamin A is protein complex includes retinol-binding protein and transthyretin in the liver and adipose tissue as a retinyl ester and circulates in the blood. The Retinal was discovered in the twentieth century by Elmer McCollum et.al (Saccà, Cutolo, & Rossi, 2019) micronutrient present in mammalian diet, of multifunctionality activities by existing in three forms: retinal, retinol and retinoic acid (Mac Askill & Anderson, 2016). Nutritional β -carotenes are turned into a retinol, comprising three basic components: a cyclohexene ring which is trimethylated and is a bulky hydrophobic group and a tetraene side chain which is connection unit and a carbon-oxygen polar group (Das et al., 2014) present in circulation eye liver kidney, other organs, and stored in liver. In general, the linker unit binds G protein of photoreceptor cell in visual



cycle. Retinoids cause differentiation and/or apoptosis in tumour cells and have anti-proliferative and anti-oxidant function, which has a high potential to research the risk of many diseases (Das et al., 2014).

Patients and Method

All patients examined with common tests for retina disorder conditions, by Diagnostic A-Scan, Fluorescein angiography is test used to diagnose and monitor the impact of diabetic retinopathy and macular degeneration, Fundus photos. Nerve fiber layer analyzer, also Visual field test by a ophthalmologist according to Patients diagnosed according to Fundus Auto Fluorescence (FAF) and Amsler grid test. the doctor checked that whether they have the symptoms for each group of cataract, diabetes or hypertension patients. Chemical Analysis done for totally 105 of both genders, at morning fasting at least for eight hours pre surgery gets started by artificial intra ocular lens for blood specimens and data were collected directly in Ibn Al Haytham Hospital, and directly analyzed, all the measured individual ages are between (16-65 year), 30 subjects are diagnosed as normal controls, and 25 subjects Cataract, 25 subjects diabetic, and 25 subjects hypertensive. Biochemical measures include serum retinol (SR) in a blood antibody-related enzyme assay often referred to as ELISA using My Bio Source package. You will use this procedure to search for some infectious diseases with antibodies. ELISA, Fasting Blood Sugar (FBS), HbA1c For HbA1c & glucose level we use Cobas c 111 Analyzer for estimation assay, blood pressure by Blood Pressure Monitor, and Blood Picture Film in Ibn Al Haytham Hospital Baghdad Iraq.

Statistical Analysis

Study carried out by SPSS-26 (Statistics Packages for Social Sciences-Version 26), data are basic measurements of frequency, percentage, mean, standard deviation SD, and range (minimum – maximum values). The students't-test for discrepancies between two separate methods or the ANOVA test was used to test the discrepancy in mean distinction (quantitative data). The difference in importance of the various percentages (qualitative data) was checked by the Pearson Chi-square test with the implementation of the Yate correction or Fisher Exact test whenever appropriate. Statistical meaning P was found to be

equal to or less than 0.05. Pearson correlation has been determined between two objective factors using a t-test to test the importance of the correlation. The magnitude of the correlation coefficient (r) is either positive (direct correlation) or negative (inverse correlation) with a value of <0.3 is not a correlation, 0.3-<0.5 is a weak correlation, 0.5-<0.7 is a moderate correlation, >0.7 is a strong correlation. Also, the correlation of r^2 was determined (the coefficient of determination), i.e. when the value of $r=0.58$, then $r^2=0.34$, which means that 34 percent of the variance of y can be compensated for by understanding the values of x or vice versa (Daniel & Cross, 2010; Daniel & Cross, 2018; Stellman, 2010).

Results and Discussion

This is the first study for retinal diseases with cataract, hypertension, and diabetes. In general, retinol concentrations were positively associated with sample collection of Iraqi volunteers, so a direct collection for blood specimens done data were collected, and directly analyzed, to avoid sample components destruction depending on the risk of male sex, older ages, in Ramadan and out of Ramadan time, at morning fasting at least for eight hours before lens replacement surgery gets started by artificial intraocular lens, for blood specimens collection, fasting glucose concentrations at baseline, antihypertensive drug use location of residence. The level of retinol for Iraqi high blood pressure volunteers was significantly higher and higher for males than females for Iraqi high blood pressure volunteers. Iraqi diabetic patients, retinol levels were significantly lower than those of Hypertension volunteers and higher than those of female diabetic patients. But for cataract patients the resulting of retinol concentration is fluctuated between Hypertension volunteers, and diabetic patients with the same condition of higher retinol level in male than in female of Iraqi cataract patients. The increased level of Hypertension volunteers is more for normal controls, cataract, and diabetic patients indicated in table1. Cataract female have more concentrations than male, and also increased levels of retinol than healthy individuals. Diabetic patients have low level among all for Retinol concentration levels. As shown in this study, Baseline characteristics of study participants by retinol are shown in Table 1A, 1B. The serum retinol concentrations are associated with each pathogenic condition. Negative association with bio



markers of diabetes, and positively for hypertension.

Table 1A. Basic features of the retinol serum sample.

		Retinol (µmol/L)			
		Hypertension	Diabetes	Cataract	Control
Age (years)	20---29	-	-	10.344±2.003	22.861±2.565
	30---39	-	24.954±	12.597±3.501	24.768±18.662
	40---49	28.911±28.548	9.736±1.814	24.698±13.364	13.312±5.168
	50---59	47.569±29.176	10.366±1.993	23.717±17.060	22.016±21.047
	60---65	16.483±10.847	15.761±9.275	27.678±22.697	16.395±
	P value	0.057	0.074	0.374	0.758
Gender	Male	25.261±22.047	15.515±8.760	20.443±14.626	23.165±16.566
	Female	22.828±22.872	10.133±2.576	21.164±18.205	20.696±16.391
	P value	0.790	0.062	0.913	0.685

Table 1B. The P value comparison for serum retinol.

	Retinol (µmol/L)	P value compared to		
		Control	Cataract	Diabetes
Hypertension	24.190±21.972 (10.233-80.000)	0.663	0.531	0.021*
Diabetes	13.147±7.195 (7.283-41.508)	0.011*	0.034*	-
Cataract	20.760±15.941 (8.154-69.514)	0.790	-	-
Control	21.930±16.241 (5.000-59.043)	-	-	-

Table 2. The P value comparison for Blood sugar levels.

	Blood sugar (mmol/L)	P value compared to		
		Control	Cataract	Diabetes
Hypertension	7.116±2.887 (3.300-13.000)	0.003*	0.004*	0.003*
Diabetes	10.256±4.119 (0.700-20.570)	0.0001*	0.0001*	-
Cataract	5.288±0.956 (3.300-8.300)	0.782	-	-
Control	5.365±1.084 (4.200-9.600)	-	-	-

This study is the first important trial in Iraq for the biochemical estimation of serum Retinol concentrations. The results suggest serum Retinol concentrations are affected with many factors: gender, age, fasting time, obesity, their social society state, anti hypertensive and hypoglycemic agents, anti inflammation drugs and location of residence. Serum concentrations for Retinol were positively associated with by each of these parameters in addition to fasting for eight hours for and pre surgery of rational diseases with each condition. High levels of blood glucose for diabetic patients owing to specific micro vascular complications such as, retinopathy, nephropathy and nephropathy, resulting in lens damage or sever retinal diseases may lead to blindness, or undergo laser surgery. We found that insulin sensitivity in liver is higher in older volunteers. It's important to give this cohort of patients and healthy controls a proper dose of Retinol as supplement as treatment for these conditions daily to refresh eye lens and compensate of the decreasing level of Retinol to

prevent eye lens damage, or viral of bacterial infections. Retinol levels for Iraqi Hypertension patients are resulting increased blood pressure due to high protein diets intake. High serum Retinol (vitamin A), levels aiming at reducing cardiometabolic risks as of earlier ages sometimes causing stroke, by inhibit thrombosis formation, and as we said before its recommended to take a supplement of Retinol instead of taking them by Nutrition especially for older ages, but by food rich with and Retinol for younger ages. Elderly persons are more vulnerable to an aggressive form of SARS-CoV-2 corona virus (COVID-19). The reshaping of the immune response among elderly individuals might explain COVID-19's age gradient. Infestation involves changes in innate and adaptive immunity to old age (Cunha, Perazzio, Azzi, Cravedi, & Riella, 2020). For that it's important to take Retinol daily to activate the immune response for older & younger ages. High levels of biochemical parameters for hypertensive patient groups with retinal diseases are due to the association of retinal



diseases with insulin resistance obesity, and increased blood pressure this agree with the study of Michael Dattilo (Dattilo, Biousse, & Newman, 2017). So, very small increase of retinol levels in retinal diseases with cataract similar to Lisa Chasan-Taber (Chasan-Taber et al., 1999) also the low retinol levels in retinal diseases with cataract, diabetes and marked increase of retinol levels in hypertension indicate their correlation with BMI, HbA1c and fasting for long time. The retinal disease groups could be an indication for using retinol and blood sugar as biochemical indicator markers for diagnosis of cataract, a type 2 DM, and hypertension. This study supported by Carsten H et.al., (Meyer & Sekundo, 2005) When Ayelet Harari, and et.al., an inverse relationship exists between glycated haemoglobin and serum retinol levels in diabetics (Harari et al., 2020). As cataracts are normal among young males, there has been widespread exposure to the relationship between axial myopia and nuclear cataract (Zhou et al., 2016). We evaluate serum retinol and sugar concentrations may have a diagnostic dependence as biochemical marker risk for lens inflammations, lens damage, and in predicting to be affected by bacteria or viral infection of cornea virus may lead to retina blood obstruction, so they regard as a monitor for their relation with lens damage stage to undergo surgery directly pre or after surgery, and in predicting occurrence of cataract, hypertension, and diabetes.

Conclusion

The study concludes the followings:

1. Retinol antioxidant significantly low levels and blood sugar have invers relation for diabetes related to starvation for more than eight hours and increased oxidative stress for metabolic disorder pre surgery resulting in this state, causing inflammations and soreness.
2. Increased concentration of retinol for hypertension shows decreased liver storage of vitamin A, development of cardiovascular diseases, and due to development and adult tissue regeneration.
3. These results suggest that improvement of Retinol as important diagnostic risk factor of potential usefulness for all retinal diseases with related states as hypotheses for further study, and a monitor for these cases also.

Authors' Declaration

- Conflicts of Interest: None.
- We hereby confirm that all the Figures and Tables in the manuscript are mine ours. Besides, the Figures and images, which are not mine ours, have been given the permission for re- publication attached with the manuscript.
- Ethical clarification: project approved by the University of Baghdad's local ethical committee.

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